

ARMATURE FOR COMMUTATOR TYPE ROTARY ELECTRIC MACHINE

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Abstract

PURPOSE:To omit coil ends of both sides by individually interposing inner conductors between both end faces of an armature core and an outer conductor along both end faces connecting a radial inner end to radial inner end of the outer conductor, and connecting the radial outer end to an armature coil.

CONSTITUTION:Inner conductors 41 are respectively fixed to both end faces of an armature core 11 through resin insulator 41a, and outer conductors 42 are respectively fixed to surfaces of both side inner conductors 41 through resin insulator 42a. The insulator 41a, the conductors 41, the insulator 42a and the conductors 42 of right side of the core 11 constitute a commutator 4 used also as a coil end. On the other hand, the insulator 41a, the conductors 41, the insulator 42a and the conductor 42 of left side of the core 11 merely constitute a coil end. Thus, since both side coil ends can be omitted, an axial length, physique and weight of a motor can be reduced without restriction in a high speed rotation by its centrifugal force resistance.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention is [0002] about the armature of the commutator type rotation electrical machinery which has a commutator.

[Description of the Prior Art] The commutator of the armature of the conventional commutator type rotation electrical machinery has two or more commutator segments which electric insulation was carried out from the axis of rotation, and were arranged in the hoop direction around the axis of rotation, respectively. JP,63-194541,A embeds partially the brush contact section extended out of shaft orientations in the surface section of the mould resin cylinder (insulating material) inserted in the axis of rotation. A conductor is embedded. the inside extended to shaft orientations, inclining inside a mould resin cylinder at a hoop direction -- while making the outside riser section extend in the direction of a path from the end of the brush contact section and carrying out electric insulation from these both between the outside riser section and an armature core -- the aforementioned inside -- the commutator segment which makes it come in the direction of a path to extend the inside riser section from the end of a conductor is indicated A coil end is omissible if it does in this way.

[0003] Moreover, the Sir face type commutator which arranged the commutator segment in the direction of a path at the radial is also known. Since it is not necessary to support a commutator segment with a Sir face type commutator in the periphery section of the above-mentioned mould resin cylinder, in high-speed rotation, it is advantageous. in order [furthermore,] for there to be a request of the formation of small lightweight and to reply to this in the direct current motor used for the starter for automobiles etc. -- JP,61-240832,A -- an armature -- it has proposed improving a space factor by considering as the variant cross section which doubled the cross-section configuration of a conductor with the slot configuration

[0004]

[Problem(s) to be Solved by the Invention] Especially in the starter for automobiles, the miniaturization is demanded for reasons of the mount. It slows down using a reducer as a means of a miniaturization, and attaining a miniaturization is performed by forming a motor into high rotation. With such high-speed commutator type rotation electrical machinery, the excessive centrifugal force committed to the coil end of the armature coil which is not held at an armature core poses a problem.

[0005] Since the coil end is ****(ed) by the hoop direction, only a predetermined pitch swelling to shaft orientations in order that an armature coil may come out of the slot of a core and may go into the following slot, it will be in the state where have a remarkable weight and shaft-orientations length and end support was carried out at the armature core, and the large centrifugal force by high-speed rotation cannot be borne. the armature which, on the other hand, extended the riser section of the commutator segment indicated by JP,63-194541,A in the radiation direction, and came out of the slot -- if a direct file is carried out to a conductor, although a coil end is omissible, the centrifugal force concerning the commutator segment to which the mass and the direction length of a path of the riser section resembled markedly, and increased as the substitute will increase far

[0006] According to the above-mentioned official report, although the commutator segment is supported by embedding to the surface section of a mould resin cylinder, and its interior in two steps, such a two-step embedded structure reduces the support intensity of the commutator segment by the mould resin cylinder. moreover -- the time of high-speed rotation -- a mould resin cylinder -- the above of a commutator segment -- the problem that a commutator segment exfoliates from a mould resin cylinder arises, without the ability supporting an excessive centrifugal force moreover, the inside which is embedded to the interior of a mould resin cylinder, and extends in shaft orientations -- since a conductor performs revolution and a curve as a substitute of a coil end, it is necessary to consider as a complicated configuration and arrangement, and manufacture is not easy furthermore, the armature where the mould

resin cylinder was embedded so much as compared with the conventional commutator -- resistance generation of heat of a conductor must be received in addition to brush frictional heat, and the thermal resistance of a mould resin cylinder also poses a problem. Moreover, about the coil end by the side of a non-commutator, it remains as it is, and high-speed rotation more than the rotational frequency which this coil end can bear cannot be desired after all.

[0007] Moreover, in the above-mentioned Sir face type commutator, a coil and the very thing do not serve as a solution at all to the problem that it is as usual and high-speed rotation is restrained by the centrifugal force concerning a coil end. Moreover, in a Sir face type commutator, in order to carry out the required pitch curve of the armature coil, this Sir face type commutator must be arranged through the coil and hold space of an armature coil from the end face of an armature core, a brush must be further made the outside every width, and there is a problem that the shaft-orientations length of a motor and the physique, and a weight increase.

[0008] furthermore, the above-mentioned official report -- like -- an armature -- for this reason, such technology has come [when improving a space factor by considering as the variant cross section which doubled the cross-section configuration of a conductor with the slot configuration / the following problems arise and] to be used widely first, an armature -- if a variant cross section is given to a conductor, work hardening will arise, and the curve will become more difficult for it to be a variant cross section, a coil end will swell, and, only in the part, the shaft-orientations length of a motor will increase. Moreover, as compared with the case of a circular cross section, it must always insert in a slot with a fixed posture, it is necessary to add predetermined torsion correctly at a coil end, and processing is complicated trouble. an armature -- the time of inserting in a slot, bending a conductor -- an armature -- possibility that the corner of a conductor will be rubbed at the entrance of a slot etc. and will serve as poor insulation can be considered

[0009] this invention is made in view of the above-mentioned trouble, can be rotated high-speed and sets it as the purpose to offer the armature of the commutator type rotation electrical machinery in which a high increase in power and the formation of small lightweight are possible.

[0010]

[Means for Solving the Problem] the outside where the armature of the commutator type rotation electrical machinery of this invention is installed along the ends side of an armature core, respectively, and the direction outer edge of a path is connected to an armature coil -- with a conductor the aforementioned ends side of the aforementioned armature core, and the aforementioned outside -- it interposes along the aforementioned ends side between conductors -- having -- the edge in the direction of a path -- the aforementioned outside -- the inside by which connects with the edge in the direction of a path of a conductor, and the direction outer edge of a path is connected to the aforementioned armature coil -- with a conductor the aforementioned inside -- a conductor -- the aforementioned armature core and the aforementioned outside -- it is characterized by having the insulator which carries out electric insulation from a conductor

[0011] a suitable mode -- setting -- the aforementioned outside -- the shaft-orientations outer edge surface of a conductor makes a brush slide contact side. In a suitable mode, an armature coil has the cross-section configuration approximated to the cross-section configuration of the slot of the aforementioned armature core.

[0012]

[Function and Effect(s) of the Invention] an outside -- a conductor is installed along the ends side of an armature core, and the direction outer edge of a path is connected to an armature coil the inside -- the outside where the conductor met the ends side and this ends side of an armature core -- it interposes individually along an ends side between conductors -- having -- the edge in the direction of a path -- an outside -- it connects with the edge in the direction of a path of a conductor, and the direction outer edge of a path is connected to an armature coil

[0013] an outside -- a conductor and the inside -- the conductor of each other [and] is insulated from an armature core by the insulator. According to this invention, the following operation effects are done so. First, since the coil end of both sides is omissible, high-speed rotation is not restrained by the centrifugal force-proof, and the shaft-orientations length of a motor and the physique, and a weight can be reduced. furthermore, each armature which constitutes an armature coil -- a conductor -- respectively -- a straight line, since it can consider as a conductor. Even when it considers as the variant cross section (un-circular) which doubled the cross-section configuration of a conductor with the slot configuration, a coil end swells and, only in the part, the shaft-orientations length of a motor does not increase. an armature -- a coil -- and -- being alike -- exact -- predetermined torsion -- it is not necessary to add -- an armature -- the case where it inserts in a slot, bending a conductor -- like -- an armature -- it is also avoidable that the insulator layer between a conductor and a slot gets damaged

[0014] After all, reduction of a high increase in power and resistance generation of heat is realizable with improvement in a space factor, the looping-around process of an armature coil avoiding complexity and becoming troublesome. a suitable mode -- setting -- the aforementioned outside -- the shaft-orientations outer edge surface of a conductor makes

a brush slide contact side If it does in this way, since it is not necessary to support a commutator segment by the surface section of a mould resin cylinder like before and the mould resin cylinder itself will become unnecessary, high-speed rotation and a high increase in power are not restrained [of the conventional mould resin cylinder / thermal and] by the mechanical load, and the shaft-orientations length of a motor and the physique, and a weight can be reduced an omitted part of a mould resin cylinder. furthermore, the frictional heat with a brush -- an outside -- although it generates in a conductor -- this outside -- since a conductor is temporarily absorbed good by the armature core which can be cooled good by the airstream which occurs in the centrifugal direction along the front face, and has large heat capacity, it is not said that a commutator restrains the heat-resistant temperature of a motor furthermore, the commutator which ****s the usual brush -- adding -- the outside of the opposite side of an armature core -- it is also possible the shaft-orientations outer edge surface of a conductor and to install the auxiliary brush to which the performance of a motor is changed, since it can be made a brush slide contact side, or to take out an electric signal from an armature coil [0015] a suitable mode -- setting -- each armature of an armature coil -- a conductor has the cross-section configuration approximated to the cross-section configuration of a slot If it does in this way, the best space factor can be attained.

[0016]

[Example]

(Example 1)

An example which applied this invention to the direct current motor of the starter for automobiles is shown in drawing 1 - drawing 3 . Drawing 1 shows the axial sectional view of this motor. the armature core 11 of the axis of rotation 10 which carried out two or more laminatings of the disk-like steel plate, and formed it is mostly attached in the center section, and two or more slots 12 form in the peripheral face of the armature core 11 -- having -- the interior -- the armature of an armature coil 2 -- two steps of upper and lower sides are looped around conductors 20 and 21 the following and 20 -- a top -- a conductor and 21 -- the bottom -- it is also called a conductor The below-mentioned commutator section 4 is formed in the right end side of the armature core 11, and the armature (rotator) of a motor is constituted. In addition, 13 is the gear prepared on the axis of rotation 10, gears with the gear of the slowdown mechanism section (for example, planet vehicle reducer style) which is not illustrated, and tells rotation of the axis of rotation 10 to the gear by which illustration is not carried out [aforementioned]. The ends of the axis of rotation 10 were supported to revolve by the bearing 61 attached in the end frame 60 of a motor, and the bearing 62 attached in the member which others do not illustrate, and the frame 60 has covered opening of the yoke 50 which consists of a cylinder steel plate. The magnetic pole core 52 to which the inner skin of a yoke 50 was looped around the field coil 51 approaches the circumference of an armature core 11, mutually, it separates to a hoop direction 90 degrees, and is fixed to it, and these yokes 50, the field coil 51, and the magnetic pole core 52 constitute four stators.

[0017] And a brush holder 70 is fixed to a frame 60, and the brush 71 is held free [shaft-orientations sliding] at the inside. And the commutator segment (outside conductor) 42 of the commutator 4 mentioned later contacts the brush 71 by pressing with the spring 72 prepared in the brush holder 70. In addition, although this example explains the direct current motor of a coil field formula, this invention of apply [it / not only to this but to the direct current motor of the magnet field formula which generates a field magnetic field with a permanent magnet and the alternating-current-system commutator motor of further others] is clear.

[0018] Next, a commutator 4 and an armature coil 2 are explained still in detail. the ends side of an armature core 11 -- resin system insulating material 41a -- inserting -- the inside -- a conductor 41 fixes, respectively -- having -- further -- the inside of both sides -- the front face of a conductor 41 -- resin system insulating material 42a -- inserting -- an outside -- the conductor 42 has fixed, respectively resin system insulating material 41a on the right-hand side of an armature core 11, and the inside -- a conductor 41, resin system insulating material 42a, and an outside -- the commutator 4 with which a conductor 42 serves as a coil end -- constituting -- **** -- resin system insulating material 41a on the left-hand side of an armature core 11, and the inside -- a conductor 41, resin system insulating material 42a, and an outside -- the conductor 42 only constitutes the coil end and resin system insulating material 41a and resin system insulating material 42a constitute the insulator as used in the field of this invention

[0019] the inside of both sides -- a conductor 41 and an outside -- the conductor 42 is arranged in the shape of a whorl in the shaft-orientations view, respectively drawing 2 -- an outside -- the arrangement state of a conductor 42 is shown the outside where 42b adjoins -- it is a laesura between conductors 42 the inside -- a conductor 41 and an outside -- although a conductor 42 pierces a copper plate, processes it and is formed, it can also be manufactured in other processes therefore, the outside installed along the right end side of an armature core 11 -- as for a conductor 42, nothing and its shaft-orientations outer edge surface make a brush slide contact side for a commutator segment moreover, the inside -- a conductor 41 -- an armature core 11 and an outside -- between conductors 42 is interposed on the direction outside of a path and each outside -- the edge in the direction of a path of a conductor 42, and each inside

-- the edge in the direction of a path of a conductor 41 is connected electrically respectively individually (this example -- an outside -- a conductor 42 and the inside -- each direction toe of a path of a conductor 41) while the contact salient is formed in the direction approached mutually of printing and only the thickness of resin system insulating material 42a contacts these contact salient in it by it at the time of assembly -- both -- contact is secured by pressing conductors 41 and 42 to an armature core 11 side

[0020] In addition, you may join this contact section with welding, soldering, soldering, etc. the inside of each slot 12 of an armature core 11 -- a top -- a conductor 20 and the bottom -- a conductor 21 inserts in a vertical couple -- having -- **** -- each outside -- the direction outer edge of a path of a conductor 42 -- a top -- it welds to the edge of a conductor 20 -- having -- each inside -- the direction outer edge of a path of a conductor 41 -- the bottom -- it is welded to the edge of a conductor 21 in addition, a top -- a conductor 20 and the bottom -- an armature coil names a conductor 21 generically Of course, soldering, soldering, press contact, etc. are also employable instead of welding.

[0021] Thereby, a single wave volume coil is completed. Of course, naturally other various coil form, such as a lap winding, is employable. drawing 3 -- the electric schematics of the armature of this invention -- being shown -- **** -- a real line part -- a top -- a conductor 20 and the dashed line section -- the bottom -- the bottom to which the conductor 21 is expressed and x is connected by the opposite side of a commutator 4 -- a conductor (armature coil) 20 and the bottom -- it is the back pitch which consists of a pitch between conductors (armature coil) 21 the bottom to which Y is connected by the commutator 4 side -- a conductor (armature coil) 20 and the bottom -- it is the front pitch which consists of a pitch between conductors (armature coil) 21 therefore -- the conventional motor -- the coil of an armature coil -- and -- being alike -- the inside of the slot of an armature coil 2 -- a conductor -- although the coil itself was incurvated and connection of a between has been made, this example shows to drawing 4 -- as -- the inside -- a conductor 41 and an outside -- it has substituted by the curve of the shape of an abbreviation whorl of a conductor 42 and the inside -- a conductor 41 and an outside -- the direction of a whorl of a conductor 42 becomes opposite drawing 4 -- setting -- the edge in the direction of a path -- the inside -- the outside which is connected to the edge in the direction of a path of a conductor 41, and is shown -- a conductor 42 is a conductor which forms the aforementioned commutator these insides -- a conductor 41 and an outside -- the pitch between the armature coil 20 connected to the direction outer edge of a path of a conductor 42 and 21 is the front pitch Y shown in drawing 3 the inside by the side of this commutator -- a conductor 41 and an outside -- the inside located in an anti-commutator side to a conductor 42 -- a conductor 41 and an outside -- although a conductor 42 has not carried out illustration, either -- a respectively separate outside -- a conductor and the inside -- the edge comrade in the direction of a path is connected to the conductor these insides -- a conductor 41 and an outside -- the pitch between the armature coil 20 connected to the direction outer edge of a path of a conductor 42 and 21 is a back pitch shown in drawing 3 in addition -- this example -- the inside -- a conductor 41 and an outside -- although, as for a conductor 42, only abbreviation 1 / 2 front pitch shall curve, respectively -- the shape of a curve or an inflectional form -- design freedom -- it is -- an outside -- a conductor 42 -- a radial -- arranging -- the inside -- you may incurvate a conductor 41 greatly [0022] above-mentioned resin system insulating material 41a and above-mentioned resin system insulating material 42a -- from an epoxy system resin -- becoming -- here -- an outside -- a conductor 42 and the inside -- although the right end side of an armature core 11 is pasted with adhesives after being formed in one of a conductor 41 and insertion mould fabrication, you may perform insulation and fixing for each in a separate heat-resistant resin web material Moreover, in the above-mentioned insertion mould fabrication, an armature core 11 can also really be fabricated by inserting.

[0023] according to [so that clearly from the above explanation] this example -- the coil end of the both sides of an armature coil 2 -- the inside -- since it is thought that it was changed into the conductor 41, the shaft-orientations length of an armature can be boiled markedly, and can be shortened, and the physique of a motor and a weight can be formed into small lightweight moreover, the resin system insulating materials 41a and 41b -- both -- since a centrifugal force works in parallel to a contact interface with conductors 41 and 42, improvement in the centrifugal-force-proof performance of a commutator 4 can be aimed at Moreover, it can realize, without slide contact area with a brush 71 also aiming at physique increase. furthermore, an outside -- it is cooled good by the centrifugal airstream produced inevitably, and the resistance heat and frictional heat which are generated in a conductor 42 are absorbed by the armature core 11 of large heat capacity good through solid-state heat transfer, and are suitable for the motor for the starters of a dust protection type Especially a reducer style is adopted, and in a motor, small and when accelerating, the effect is greatest. [0024] furthermore, each armature which constitutes an armature coil 2 -- conductors 20 and 21 -- respectively -- a straight line -- since it can consider as a conductor -- an armature -- without a coil end swells like before also as a variant cross section (un-circular) which doubled the cross-section configuration of a conductor with the slot configuration -- an armature -- the coil of a conductor -- and -- being alike -- exact -- predetermined torsion -- it is not necessary to add -- an armature -- since a conductor is not bent, the insulator layer does not separate That is, reduction of a high increase in power and resistance generation of heat is realizable with improvement in a space

factor, the looping-around process of an armature coil 2 avoiding complexity and becoming troublesome. a suitable mode -- setting -- each outside -- a conductor 42 and each inside -- the conductor 41 has connected electrically between the armature coil 20 separated by 1 front pitch, and 21 a suitable mode -- setting -- each outside -- a conductor and each inside -- the conductor has connected electrically between the armature coils separated by 1 back pitch If it does in this way, electrical installation of the armature coil separated by part for 1 front pitch performed at the coil end of an armature coil and 1 back pitch will be conventionally made very short in shaft orientations. [0025] drawing 5 and drawing 6 -- an armature -- the example which anomaly-ized conductors 20 and 21 according to the cross-section configuration of a slot 12 is shown 22 is an insulating layer within a slot. in addition -- the above-mentioned example -- a right-hand side outside -- although the conductor 42 was made into the commutator segment instead, the commutator which has the commutator segment extended to shaft orientations like usual is also employable

(Example 2)

Other examples are shown in drawing 7 .

[0026] the outside which adjoins in this example -- salient 42c which projects to shaft orientations is prepared in the periphery section of laesura 42b between conductors 42 salient 42c is formed in resin system insulating material 42a and one -- having -- an outside -- it has projected on the shaft-orientations outside rather than the conductor 42 thus -- if it carries out -- this salient 42c -- centrifugal wings -- becoming -- an outside -- a centrifugal airstream is occurred along with the outside surface of a conductor 42, and good cooling is enabled

[0027] In addition, in drawing 7 , the concentric circle field surrounded with the alternate long and short dash line serves as a brush slide contact side, and this salient 42c does not interfere with a brush.

(Example 3)

Other examples are shown in drawing 8 . this example -- an armature -- the both-sides nose of cam of conductors 20 and 21 -- the drill-like salients 20a and 21a -- preparing -- on the other hand -- the inside -- a conductor 41 and an outside -- **** 41d and 42d which the these drill-like salients 20a and 21a insert in a conductor 42 is formed

[0028] And the commutator 4 which was beforehand combined by the resin system insulating materials 41a and 42a, and was made into the semi assembly is set by the end face of an armature core 11, and the drill-like salients 20a and 21a are inserted in **** 41d and 42d. The drill-like salients 20a and 21a are taken as **** of 41d, and the size of 42d or more. thus, the armature which will consist of copper if this semi assembly is pressed to the right end side of an armature core 11 according to the forcing force of shaft orientations -- the inside which the drill-like salients 20a and 21a of conductors 20 and 21 become from a hard steel -- a conductor 41 and an outside -- it deforms plastically within 41d of **** of a conductor 42, and 42d, and joins together closely

[0029] Of course, an example made the bond part the shape of a drill, and various bond-part configurations, such as the shape of a cylinder and a taper and tubed, are possible for it. thus, the armature which consists of comparatively soft copper and aluminum -- heating at high temperature does not need connection by the plastic deformation of conductors 20 and 21, but it is easy and degradation of the resin system insulating materials 41a and 42a can also be avoided

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CLAIMS

(57) [Claim(s)]

[Claim 1] The armature of the commutator type rotation electrical machinery characterized by providing the following the outside where it is installed along the ends side of an armature core, respectively, and the direction outer edge of a path is connected to an armature coil -- a conductor the aforementioned ends side of the aforementioned armature core, and the aforementioned outside -- it interposes along the aforementioned ends side between conductors -- having -- the edge in the direction of a path -- the aforementioned outside -- the inside by which connects with the edge in the direction of a path of a conductor, and the direction outer edge of a path is connected to the aforementioned armature coil -- a conductor and the aforementioned inside -- a conductor -- the aforementioned armature core and the aforementioned outside -- the insulator which carries out electric insulation from a conductor

[Claim 2] the aforementioned outside -- the armature of the commutator type rotation electrical machinery according to claim 1 for which the shaft-orientations outer edge surface of a conductor makes a brush slide contact side

[Claim 3] The aforementioned armature coil is the armature of the commutator type rotation electrical machinery according to claim 1 which has the cross-section configuration approximated to the cross-section configuration of the slot of the aforementioned armature core.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the axial sectional view of the commutator type rotation electrical machinery which applied the example 1.

[Drawing 2] the outside of drawing 1 -- it is the plot plan of a conductor

[Drawing 3] a part of armature coil of drawing 1 -- it is a plugging chart

[Drawing 4] It is the ** type perspective diagram showing the armature coil of drawing 1 , and the arrangement state of a commutator.

[Drawing 5] the armature of drawing 1 -- it is the direction expanded sectional view of a path showing an example of a conductor

[Drawing 6] the armature of drawing 1 -- it is the direction expanded sectional view of a path showing the other examples of a conductor

[Drawing 7] the outside which applied the example 2 -- it is the plot plan of a conductor

[Drawing 8] It is the important section expansion axial sectional view of the commutator type rotation electrical machinery which applied the example 3.

[Description of Notations]

4 -- a commutator and 10 -- the axis of rotation and 11 -- an armature core and 12 -- a slot, and 20 and 21 -- an armature coil and 41 -- the inside -- a conductor and 42 -- an outside -- a conductor, and 41a and 42a -- a resin system insulating material (insulator) and 71 -- a brush

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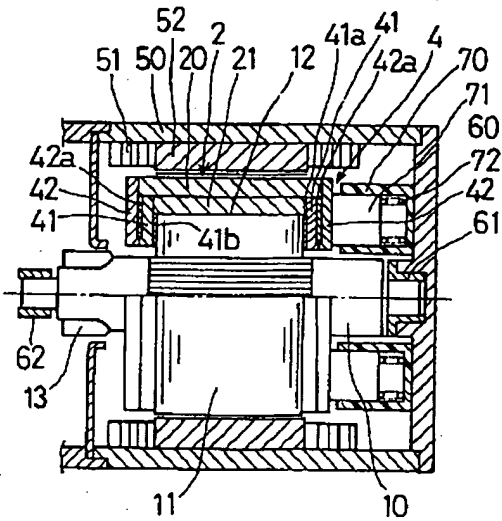
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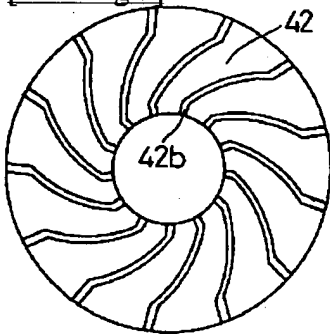
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DRAWINGS

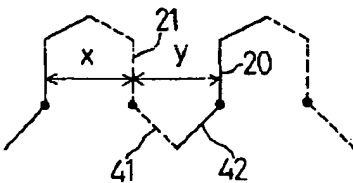
[Drawing 1]



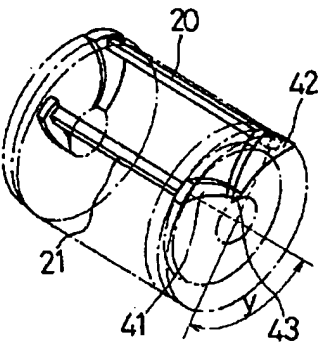
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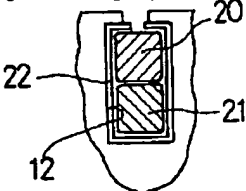
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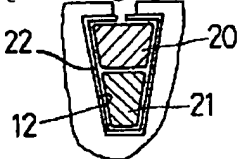
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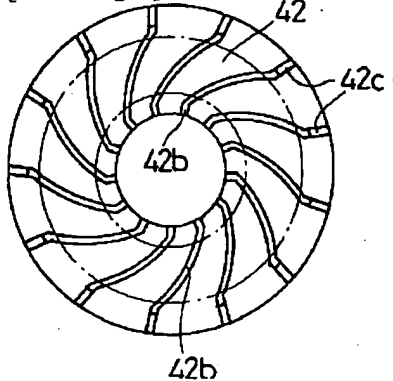
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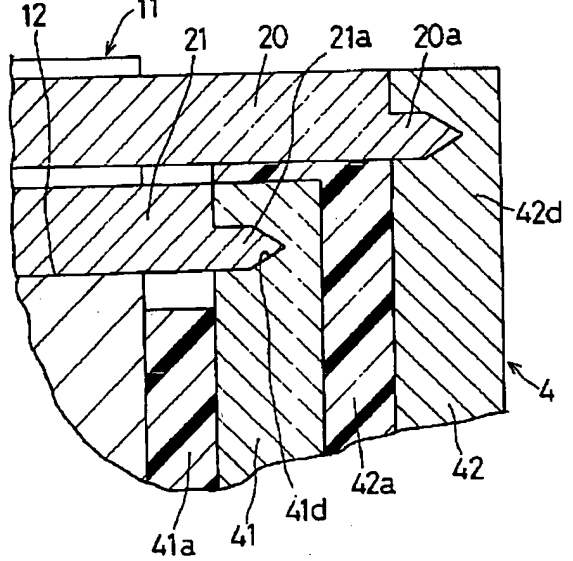
[Drawing 6]



[Drawing 7]



[Drawing 8]



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(54) 【発明の名称】 整流子型回転電機の電機子

(57) 【特許請求の範囲】

【請求項 1】 電機子鉄心の両端面に沿ってそれぞれ延設されて、径方向外端が電機子コイルに接続される外側導体と、

前記電機子鉄心の前記両端面と前記外側導体との間に前記両端面に沿って介設され、径方向内端が前記外側導体の径方向内端に接続され、径方向外端が前記電機子コイルに接続される内側導体と、

前記内側導体を前記電機子鉄心及び前記外側導体から電気絶縁する絶縁体と、

を備えることを特徴とする整流子型回転電機の電機子。

【請求項 2】 前記外側導体の軸方向外端面がブラシ摺接面をなす請求項 1 記載の整流子型回転電機の電機子。

【請求項 3】 前記電機子コイルは、前記電機子鉄心のスロットの断面形状に近似する断面形状を有する請求項 1

記載の整流子型回転電機の電機子。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 この発明は、整流子を有する整流子型回転電機の電機子に関する

【0002】

【従来の技術】 従来の整流子型回転電機の電機子の整流子は、回転軸から電気絶縁されて回転軸の周囲にそれぞれ周方向へ並べられた複数の整流子片を有している。特開昭 63-194541 号公報は、回転軸に嵌められたモールド樹脂筒（絶縁材）の表面部に軸方向外に伸びるブラシ接触部を部分的に埋め込み、モールド樹脂筒の内部に周方向に傾斜しつつ軸方向へ延伸する内側導体を埋め込み、ブラシ接触部の一端から径方向へ外側ライザ部を延伸させ、外側ライザ部と電機子鉄心との間にこれ

ら両者から電気絶縁しつつ前記内側導体の一端から径方向に内側ライザ部を延伸させてなる整流子片を開示している。このようにすれば、コイルエンドを省略することができる。

【0003】また、整流子片を径方向に放射状に配列したサーフェイス型整流子も知られている。サーフェイス型整流子では、整流子片を上記モールド樹脂筒の外周部に担持しなくてもよいので、高速回転において有利である。更に、自動車用スタータなどに用いられる直流電動機では、小型軽量化の要請があり、これに答えるために、特開昭61-240832号公報は、電機子導体の断面形状をスロット形状に合わせた異形断面とすることにより占積率を向上することを提案している。

【0004】

【発明が解決しようとする課題】自動車用スタータにおいては、その車載を理由に小型化が特に要求されている。小型化の手段として減速機を用いて減速し、電動機を高回転化することにより小型化を図ることが行われている。このような高速の整流子型回転電機では、電機子鉄心に保持されない電機子コイルのコイルエンドに働く過大な遠心力が問題となる。

【0005】コイルエンドは電機子コイルがコアのスロットから出て次のスロットへ入るため所定のピッチだけ軸方向に膨らみつつ周方向に曲設されているので、かなりの重量と軸方向長を有して電機子鉄心に一端支持された状態となり、高速回転による大遠心力に耐えられない。一方、特開昭63-194541号公報に開示される整流子片のライザ部を放射方向に延伸してスロットから出た電機子導体に直接接続すると、コイルエンドを省略できるが、その代わりとして、ライザ部の質量及び径方向長さが格段に増大した整流子片に掛かる遠心力がはるかに増大してしまう。

【0006】上記公報によれば、整流子片は、モールド樹脂筒の表面部及びその内部に2段に埋め込むことにより支持されているが、このような2段埋め込み構造はモールド樹脂筒による整流子片の支持強度を低下させる。また、高速回転時にはモールド樹脂筒が整流子片の上記過大な遠心力を支持できずに、整流子片がモールド樹脂筒から剥離するという問題が生じる。また、モールド樹脂筒の内部に埋め込まれて軸方向に延在する内側導体はコイルエンドの代わりとして旋回、湾曲を行うので、複雑な形状、配置とする必要があり、製作は容易ではない。更に、モールド樹脂筒は従来の整流子に比較して多量に埋め込まれた電機子導体の抵抗発熱をブラシ摩擦熱以外に受容せねばならず、モールド樹脂筒の耐熱性も問題となる。その上、非整流子側のコイルエンドについてはそのままであり、結局、このコイルエンドが耐えられる回転数以上の高速回転は望めない。

【0007】また、上記したサーフェイス型整流子では、コイルエンド自体は従来通りであり、コイルエンド

に掛かる遠心力により高速回転が制約されるという問題に対しなんら解決策とはならない。また、サーフェイス型整流子では、電機子コイルを必要ピッチ湾曲するために電機子鉄心の端面から電機子コイルのコイルエンド收容空間を介してこのサーフェイス型整流子を配設し、更にその外側にブラシを横置きせねばならず、モータの軸方向長及び体格、重量が増大するという問題がある。

【0008】更に、上記した公報のように、電機子導体の断面形状をスロット形状に合わせた異形断面とすることにより占積率を向上する場合、以下のような問題が生じ、このために、このような技術は広く用いられるにはいたっていない。まず、電機子導体に異形断面を与えると、加工硬化が生じ、また、異形断面であるとその湾曲がより困難となり、コイルエンドが膨らんでその分だけモータの軸方向長さが増大してしまう。また、円形断面の場合に比較して常に一定姿勢でスロットに挿入せねばならないのでコイルエンドにて正確に所定の振じりを加える必要があり加工が複雑面倒である。電機子導体を曲げつつスロットに挿入する際に電機子導体の角部がスロットの入口などでこすられて絶縁不良となる可能性が考えられる。

【0009】本発明は、上記問題点に鑑みなされたものであり、高速回転が可能で高出力化、小型軽量化が可能な整流子型回転電機の電機子を提供することを、その目的としている。

【0010】

【課題を解決するための手段】本発明の整流子型回転電機の電機子は、電機子鉄心の両端面に沿ってそれぞれ延設されて、径方向外端が電機子コイルに接続される外側導体と、前記電機子鉄心の前記両端面と前記外側導体との間に前記両端面に沿って介設され、径方向内端が前記外側導体の径方向内端に接続され、径方向外端が前記電機子コイルに接続される内側導体と、前記内側導体を前記電機子鉄心及び前記外側導体から電気絶縁する絶縁体と、を備えることを特徴としている。

【0011】好適な態様において、前記外側導体の軸方向外端面がブラシ摺接面をなす。好適な態様において、電機子コイルは、前記電機子鉄心のスロットの断面形状に近似する断面形状を有する。

【0012】

【作用及び発明の効果】外側導体は、電機子鉄心の両端面に沿って延設されて、径方向外端が電機子コイルに接続される。内側導体は、電機子鉄心の両端面とこの両端面に沿った外側導体との間に両端面に沿って個別に介設され、径方向内端が外側導体の径方向内端に接続され、径方向外端が電機子コイルに接続される。

【0013】外側導体及び内側導体は絶縁体により互いにかつ電機子鉄心から絶縁される。本発明によれば、以下の作用効果を奏する。まず、両側のコイルエンドを省略できるので、その耐遠心力により高速回転を制約され

ることがなく、かつモータの軸方向長及び体格、重量を縮小できる。更に、電機子コイルを構成する各電機子導体はそれぞれ直線導体とすることができるので、電機子導体の断面形状をスロット形状に合わせた異形断面（非円形）とした場合でもコイルエンドが膨らんでその分だけモータの軸方向長さが増大してしまうことがなく、コイルエンドにて正確に所定の振じりを加える必要もなく、電機子導体を曲げつつスロットに挿入する場合のように電機子導体とスロットとの間の絶縁膜が傷つくことも回避できる。

【0014】結局、電機子コイルの巻装工程が複雑、面倒となるのを回避しつつ占積率の向上により高出力化、抵抗発熱の低減を実現することができる。好適な態様において、前記外側導体の軸方向外端面がブラシ摺接面をなす。このようにすれば、従来のようにモールド樹脂筒の表面部により整流子片を担持する必要がなく、かつ、モールド樹脂筒自体が不要となるので、従来のモールド樹脂筒の熱的、機械的負荷により高速回転、高出力化が制約されることがなく、かつ、モールド樹脂筒の省略分だけモータの軸方向長及び体格、重量を縮小できる。更にブラシによる摩擦熱は外側導体において発生するが、この外側導体はその表面に沿って遠心方向に生じられる空気流により良好に冷却されることができ、また大熱容量をもつ電機子鉄心に一時的に良好に吸収されるので、整流子がモータの耐熱温度を制約するということがない。さらに、通常のブラシを摺接する整流子に加え、電機子鉄心の反対側の外側導体の軸方向外端面もブラシ摺接面にすることができるので、電動機の性能を変化させる補助ブラシを設置したり、電機子コイルから電気的信号を取り出したりすることも可能である。

【0015】好適な態様において、電機子コイルの各電機子導体は、スロットの断面形状に近似する断面形状を有する。このようにすれば、最良の占積率を達成することができる。

【0016】

【実施例】

（実施例1）

本発明を自動車用スタータの直流電動機に適用した一例を図1～図3に示す。図1はこのモータの軸方向断面図を示す。回転軸10のほぼ中央部には円盤状の鋼板を複数積層して形成した電機子鉄心11が嵌着されており、電機子コア11の外周面には複数のスロット12が形成され、その内部には電機子コイル2の電機子導体20、21が上下二段に巻装されている。以下、20は上側導体、21は下側導体とも呼ばれる。電機子コア11の右端面には後述の整流子部4が形成されて電動機の電機子（回転子）を構成している。なお、13は回転軸10上に設けられたギヤで、図示されない減速機構部（例えば遊星車減速機構）のギヤと噛み合い、回転軸10の回転を前記図示されないギヤに伝える。回転軸10の両端

は、電動機のエンドフレーム60に取り付けた軸受61と他の図示しない部材に取り付けた軸受62により軸支され、エンドフレーム60は、円筒鋼板からなるヨーク50の開口を遮蔽している。ヨーク50の内周面には界磁コイル51が巻装された磁極コア52が電機子鉄心11の周囲に近接して4個、互いに周方向に90度離れて固定されており、これらヨーク50、界磁コイル51及び磁極コア52が固定子を構成している。

【0017】エンドフレーム60にはブラシホルダ70が固定され、その内側にはブラシ71が軸方向摺動自在に保持されている。そして、ブラシホルダ70内に設けられたスプリング72によってブラシ71は後述する整流子4の整流子片（外側導体）42に押接されている。なお、この実施例では巻線界磁式の直流電動機について説明しているが、本発明はこれに限らず永久磁石により界磁磁界を発生する磁石界磁式の直流電動機、更には他の交流式整流子電動機にも適用し得ることは明らかである。

【0018】次に、整流子4及び電機子コイル2を更に詳細に説明する。電機子鉄心11の両端面には樹脂系絶縁材41aを挟んで内側導体41がそれぞれ固着され、更に両側の内側導体41の表面に樹脂系絶縁材42aを挟んで外側導体42がそれぞれ固着されている。電機子鉄心11の右側の樹脂系絶縁材41a、内側導体41、樹脂系絶縁材42a及び外側導体42はコイルエンドを兼ねる整流子4を構成しており、電機子鉄心11の左側の樹脂系絶縁材41a、内側導体41、樹脂系絶縁材42a及び外側導体42は単にコイルエンドを構成しており、樹脂系絶縁材41a及び樹脂系絶縁材42aは本発明でいう絶縁体を構成している。

【0019】両側の内側導体41及び外側導体42はそれぞれ軸方向矢視にて渦巻き状に配設されている。図2に外側導体42の配置状態を示す。42bは隣接する外側導体42間の条溝である。内側導体41及び外側導体42は、銅板を打ち抜き加工して形成されているが他の製法にて製造することもできる。したがって、電機子鉄心11の右端面に沿って延設された外側導体42は整流子片をなし、その軸方向外端面がブラシ摺接面をなす。また、内側導体41は電機子鉄心11と外側導体42との間を径方向外側へ介設されている。そして、各外側導体42の径方向内端と各内側導体41の径方向内端とがそれぞれ個別に電気的に接続されている（この実施例では外側導体42及び内側導体41の各径方向内端部は、互いに接近する方向に打ち出しにより樹脂系絶縁材42aの厚さだけ接触突起が形成されており、組立時に、これら接触突起を接触させつつ両導体41、42を電機子鉄心11側へ押圧することにより接触を確保している。

【0020】なお、この接触部を溶接、ろう付け、はんだ付け等で接合してもよい。電機子鉄心11の各スロット12内には上側導体20と下側導体21とが上下一対

に挿入されており、各外側導体42の径方向外端は上側導体20の端部に溶接され、各内側導体41の径方向外端は下側導体21の端部に溶接されている。なお、上側導体20及び下側導体21は、電機子コイルとも総称する。もちろん、溶接の代わりに、ろう付け、はんだ付け、押圧接触などを採用することもできる。

【0021】これにより、一重波巻き巻線が完成される。もちろん、重ね巻きなど他の種々の巻線形式を採用できることは当然である。図3は、本発明の電機子の電氣的結線図を示しており、実線部が上側導体20、破線部が下側導体21を表わしており、xは、整流子4の反対側で接続される上側導体（電機子コイル）20と下側導体（電機子コイル）21との間のピッチからなるバックピッチである。Yは整流子4の側で接続される上側導体（電機子コイル）20と下側導体（電機子コイル）21間のピッチからなるフロントピッチである。したがって、従来のモータでは電機子コイルのコイルエンドにて電機子コイル2のスロット内導体間の接続をコイル自体を湾曲させて行ってきたが、この実施例では図4に示すように内側導体41及び外側導体42の略過巻き状の湾曲により代替している。そして、内側導体41及び外側導体42の過巻き方向は反対となる。図4において、径方向内端が内側導体41の径方向内端に接続されて示されている外側導体42は、前記整流子を形成する導体である。これら内側導体41及び外側導体42の径方向外端に接続されている電機子コイル20、21間のピッチは図3に示すフロントピッチYである。この整流子側の内側導体41と外側導体42に対して、反整流子側に位置する内側導体41と外側導体42も、図示はしていないが、それぞれ別々の外側導体と内側導体に、その径方向内端同志が接続されている。これら内側導体41及び外側導体42の径方向外端に接続されている電機子コイル20、21間のピッチは図3に示すバックピッチである。なお、この実施例では、内側導体41及び外側導体42は、それぞれ略1/2フロントピッチだけ湾曲するものとするが、湾曲又は屈折形状は設計自由であり、外側導体42を放射状に配置し、内側導体41を大きく湾曲させてもよい。

【0022】上記した樹脂系絶縁材41a及び樹脂系絶縁材42aはエポキシ系樹脂からなり、ここでは外側導体42及び内側導体41とインサートモールド成形により一体に形成された後、接着剤にて電機子鉄心11の右端面に接着されているが、それぞれを別個の耐熱樹脂シート材にて絶縁及び固着を行ってもよい。また上記インサートモールド成形において、インサートすることにより電機子鉄心11も一体成形することもできる。

【0023】以上の説明から明らかなように、本実施例によれば電機子コイル2の両側のコイルエンドが内側導体41に変換されたと考えられるので、電機子の軸方向長さを格段に短縮し、モータの体格、重量を小型軽量化

することができる。また、樹脂系絶縁材41a、41bと両導体41、42との接触界面に対して遠心力が平行方向に働くので整流子4の耐遠心力性能の向上が図れる。また、ブラシ71との摺接面積も体格増大を図ることなく実現することができる。更に外側導体42で発生する抵抗熱及び摩擦熱は必然的に生じる遠心空気流により良好に冷却され、かつ、大熱容量の電機子鉄心11に固体伝熱を通じて良好に吸収され、全閉型のスタータ用の電動機に適している。特に減速機構を採用して電動機を小型・高速化する場合にはその効果は絶大である。

【0024】更に、電機子コイル2を構成する各電機子導体20、21はそれぞれ直線導体とすることができるので、電機子導体の断面形状をスロット形状に合わせた異形断面（非円形）としても、従来のように、コイルエンドが膨らむこともなく、電機子導体のコイルエンドにて正確に所定の握り加えを必要もなく、電機子導体を曲げないのでその絶縁膜が剥がれることも無い。すなわち、電機子コイル2の巻装工程が複雑、面倒となるのを回避しつつ、占積率の向上により高出力化、抵抗発熱の低減を実現することができる。好適な態様において、各外側導体42及び各内側導体41は、1フロントピッチ分隔した電機子コイル20、21間を電氣的に接続している。好適な態様において、各外側導体及び各内側導体は、1バックピッチ分隔した電機子コイル間を電氣的に接続している。このようにすれば従来、電機子コイルのコイルエンドで行ってきた1フロントピッチ分及び1バックピッチ分隔した電機子コイルの電氣的接続が軸方向に極めて短くできる。

【0025】図5及び図6に電機子導体20、21をスロット12の断面形状に合わせて異形化した例を示す。22はスロット内絶縁層である。なお、上記実施例では、右側の外側導体42を整流子片としたが、その代わりに通常のように軸方向に伸びる整流子片を有する整流子を採用することもできる。

（実施例2）

他の実施例を図7に示す。

【0026】この実施例では、隣接する外側導体42の間の条溝42bの外周部に軸方向へ突出する突起42cを設けたものである。突起42cは、樹脂系絶縁材42aと一体に形成され、外側導体42よりも軸方向外側に突出している。このようにすれば、この突起42cが遠心翼となって外側導体42の外表面に沿って遠心空気流を生起し、良好な冷却を可能とする。

【0027】なお、図7では、一点鎖線で囲まれた同心円領域がブラシ摺接面となり、この突起42cがブラシと干渉することは無い。

（実施例3）

他の実施例を図8に示す。この実施例では、電機子導体20、21の両側先端に錐状突起20a、21aを設け、一方、内側導体41及び外側導体42にこれら錐状

突起20a、21aが嵌入する錐孔41d、42dを設けている。

【0028】そして、予め樹脂系絶縁材41a、42aにより結合されてセミアセンブリとされた整流子4を電機子鉄心11の端面に合わせ、錐状突起20a、21aを錐孔41d、42dに嵌入する。錐状突起20a、21aは錐孔41d、42d以上の大きさとする。このようにして、軸方向の押し付け力によりこのセミアセンブリを電機子鉄心11の右端面に押圧すれば、銅からなる電機子導体20、21の錐状突起20a、21aが硬銅からなる内側導体41及び外側導体42の錐孔41d、42d内で塑性変形し、緊密に結合する。

【0029】もちろん、結合部を錐状としたのは一例であり棒状、テーパ状、筒状など各種結合部形状が可能である。このように比較的軟らかい銅、アルミからなる電機子導体20、21の塑性変形により接続は高温加熱が要らず、簡単であり、樹脂系絶縁材41a、42aの劣化も回避することができる。

【図面の簡単な説明】

【図1】実施例1を適用した整流子型回転電機の軸方向断面図である。

【図2】図1の外側導体の配置図である。

【図3】図1の電機子コイルの一部配線図である。

【図4】図1の電機子コイル及び整流子の配置状態を示す模式斜視図である。

【図5】図1の電機子導体の一例を示す径方向拡大断面図である。

【図6】図1の電機子導体の他例を示す径方向拡大断面図である。

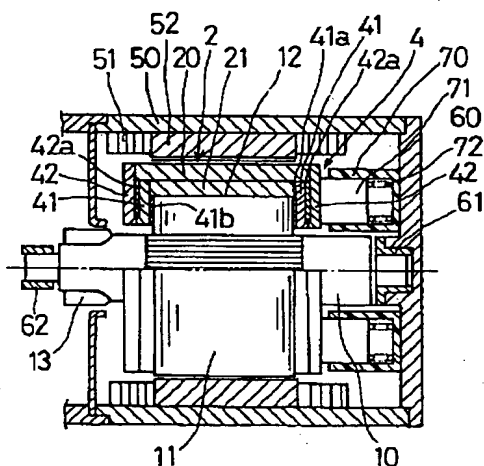
【図7】実施例2を適用した外側導体の配置図である。

【図8】実施例3を適用した整流子型回転電機の要部拡大軸方向断面図である。

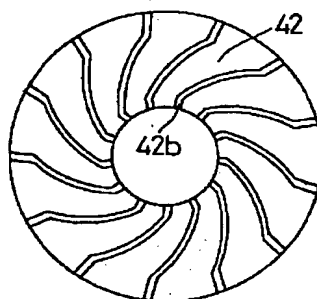
【符号の説明】

4は整流子、10は回転軸、11は電機子鉄心、12はスロット、20、21は電機子コイル、41は内側導体、42は外側導体、41a、42aは樹脂系絶縁材（絶縁体）、71はブラシ。

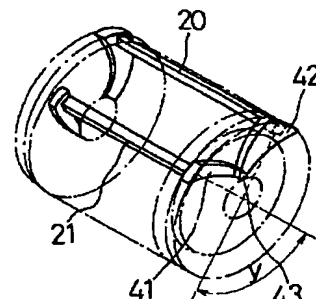
【図1】



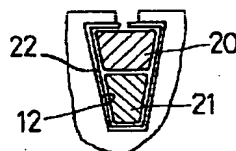
【図2】



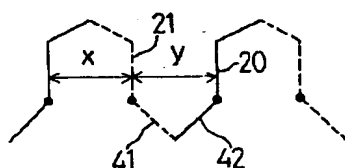
【図4】



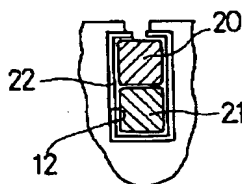
【図6】



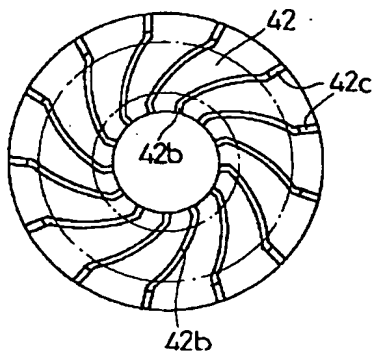
【図3】



【図5】



【図 7】



【图8】

